What is claimed is:

1. A method of forming a magnetic field of field reverse topology and confining plasma comprising the steps of

injecting a plasma into a chamber,

applying a magnetic field to form a first magnetic field in the chamber having unidirectional field lines,

injecting ion beams into the chamber substantially transverse to the first magnetic field,

trapping the ion beams in betatron orbits within the first magnetic field,

forming a rotating beam plasma within the chamber having a current, the beam plasma comprising ions and electrons,

forming a poloidal second magnetic field about the rotating beam plasma having external field lines outside the rotating plasma extending in a same direction as the field lines of the first magnetic field and internal field lines extending in an opposite direction to the field lines of the first magnetic field ,

injecting a current through a betatron flux coil in the chamber,

inducing an azimuthal electric field inside the chamber,

increasing the rotating beam plasma's rotational velocity,

increasing the second magnetic field's magnitude beyond the magnitude of the first magnetic field,

reversing the direction of the internal field within the rotating plasma and forming a combined magnetic field of field reverse topology (FRC),

generating an electrostatic field,

magnetically confining a plurality of the beam plasma ions, and

electrostatically confining a plurality of the beam plasma electrons.

2. The method of claim 1 wherein the ion beams are injected substantially transverse to the first magnetic field.

self-field's magnitude beyond the applied magnetic field's magnitude causing field reversal internal to the rotating beam plasma and formation of a combined magnetic field having a field reversed configuration (FRC),

generating an electrostatic field within the reactor chamber,

confining a plurality of beam plasma ions within the reactor chamber through magnetic confinement of ions, and

confining a plurality of beam plasma electrons within the reactor chamber through electrostatic confinement of electrons.

12. The method of claim 11 wherein the step of applying a magnetic field includes energizing a plurality of field coils extending about the chamber.

13. The method of claim 11 wherein the ion beams are injected substantially transverse to the applied magnetic field.

14. The method of claim 13 wherein the step of injecting the ion beams further comprises the steps of

neutrilizing the ion beams,

draining the neutralized ion beams' electric polarization, and

exerting a Lorentz force due to the magnetic field on the neutralized ion beams to bend the ion beams into betatron orbits.

15. The method of claim 11 further comprising the step of increasing the applied magnetic field's magnitude to maintain the rotating beam plasma at a predetermined radial size.

16. The method of claim 11 wherein step of increasing the rotating beam plasma's rotational velocity includes the step of energizing a betatron flux coil within the chamber inducing an azimuthal electric field within the chamber.

17. The method of claim 16 further comprising the step increasing the current through the flux coil to accelerate the rotating beam plasma to a fusion relevant rotational energy.

18. The method of claim 17 further comprising the steps of injecting high energy ion beams into the FRC and trapping the beams in betatron orbits within the FRC.

19. The method of claim 18 wherein the step of generating an electrostatic field includes applying the applied magnetic field at a magnitude that corresponds to an electrostatic field that is confining to a plurality of beam plasma electrons.

20. A method confining a plasma within a chamber comprising the steps of

forming a field reversed configuration (FRC) magnetic field within a reactor chamber about a rotating beam plasma comprising ions and electrons,

applying a magnetic field to the reactor chamber,

injecting ion beams into the reactor chamber,

generating an electrostatic field within the reactor chamber,

confining a plurality of beam plasma ions within the reactor chamber through magnetic confinement of ions, and

confining a plurality of beam plasma electrons within the reactor chamber through electrostatic confinement of electrons.

21. The method of claim 20 wherein the step of forming a FRC magnetic field comprises the steps of

injecting ion beams into a background plasma within the reactor chamber,

forming a rotating beam plasma,

generating a poloidal magnetic self-field about the rotating beam plasma, and

increasing the rotating beam plasma's rotational velocity to increase the magnetic self-field's magnitude beyond the applied magnetic field's magnitude causing field reversal internal to the rotating beam plasma and formation of the FRC.

22. The method of claim 20 wherein the step of applying a magnetic field includes energizing a plurality of field coils extending about the chamber.

23. The method of claim 20 wherein the ion beams are injected substantially transverse to the applied magnetic field.

24. The method of claim 23 wherein the step of injecting the ion beams further comprises the steps of

neutrilizing the ion beams,

draining the neutralized ion beams' electric polarization, and

exerting a Lorentz force due to the magnetic field on the neutralized ion beams to bend the ion beams into betatron orbits.

25. The method of claim 20 further comprising the step of increasing the applied magnetic field's magnitude to maintain the rotating beam plasma at a predetermined radial size.

26. The method of claim 20 wherein step of increasing the rotating beam plasma's rotational velocity includes the step of energizing a betatron flux coil within the chamber creating an azimuthal electric field within the chamber.

27. The method of claim 26 further comprising the step increasing the current through the flux coil to accelerate the rotating beam plasma to a fusion relevant rotational energy.

28. The method of claim 27 further comprising the steps of injecting high energy ion beams into the FRC and trapping the beams in betatron orbits within the FRC.

29. The method of claim 28 wherein the step of generating an electrostatic field includes applying the applied magnetic field at a magnitude that corresponds to an electrostatic field that is confining to a plurality of beam plasma electrons.

30. A method confining a plasma of ions and electrons within a chamber comprising the steps of

magnetically confining a plurality of plasma ions, and

electrostatically confining a plurality of plasma electrons.

31. The method of claim 30 further comprising the step of forming a field reversed configuration (FRC) magnetic field within a reactor chamber about a rotating beam plasma comprising ions and electrons.

32. The method of claim 31 further comprising the step of applying a magnetic field to the reactor chamber.

33. The method of claim 32 further comprising the step of injecting ion beams into the reactor chamber.

34. The method of claim 30 further comprising the step of generating an electrostatic field within the reactor chamber.

35. The method of claim 32 wherein the step of forming a FRC magnetic field comprises the steps of

injecting ion beams into a background plasma within the reactor chamber and forming a rotating beam plasma,

generating a poloidal magnetic self-field about the rotating beam plasma, and

increasing the rotating beam plasma's rotational velocity to increase the magnetic self-field's magnitude beyond the applied magnetic field's magnitude causing field reversal internal to the rotating beam plasma and formation of the FRC.

36. The method of claim 32 wherein the step of applying a magnetic field includes energizing a plurality of field coils extending about the chamber.

37. The method of claim 33 wherein the ion beams are injected substantially transverse to the applied magnetic field.

38. The method of claim 37 wherein the step of injecting the ion beams further comprises the steps of

neutrilizing the ion beams,

draining the neutralized ion beams' electric polarization, and

exerting a Lorentz force due to the magnetic field on the neutralized ion beams to

bend the ion beams into betatron orbits.

39. The method of claim 31 further comprising the step of tuning the applied magnetic field's magnitude to maintain the rotating beam plasma at a predetermined radial size.

40. The method of claim 35 wherein step of increasing the rotating beam plasma's rotational velocity includes the step of running current through a betatron flux coil within the chamber inducing an azimuthal electric field within the chamber.

41. The method of claim 40 further comprising the step increasing the current through the flux coil to accelerate the rotating beam plasma to a fusion relevant rotational energy.

42. The method of claim 41 further comprising the steps of injecting high energy ion beams into the FRC and trapping the beams in betatron orbits within the FRC.

43. The method of claim 34 wherein the step of generating an electrostatic field includes applying an applied magnetic field at a magnitude that corresponds to an electrostatic field that is confining to a plurality of beam plasma electrons.